

PATENT APPLICATION

of

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for

APPARATUS AND METHOD FOR PRODUCING
DECORATED PLASTIC PRODUCT

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APPARATUS AND METHOD FOR PRODUCING DECORATED PLASTIC PRODUCT

BACKGROUND

The present disclosure relates to apparatus and methods for producing
5 decorated plastic products. More particularly, the present disclosure relates to
configuration and operation of a production line to produce products made of a
plastics material.

It is often desirable for products made of a plastics material to be
decorated. Such decoration may be desirable for a variety of reasons. For example,
10 decoration may be applied to plastic products for reasons of aesthetics, advertising, or
communication of other information, to name just a few.

SUMMARY

According to the present disclosure, a method of operating a
15 production line to produce a decorated plastic product is disclosed. A strip of plastics
material is extruded from a strip extruder and moved along the production line in
sequence from the strip extruder past a decoration media dispenser to a thermoformer.
At the decoration media dispenser, decoration media is dispensed from the decoration
media dispenser onto at least a portion of the strip. The thermoformer is used to heat
20 and form the decorated strip portion into the plastic product.

In illustrative embodiments, the decoration media dispenser may be
positioned at different locations in the production line between the strip extruder and
the thermoformer. In one example, the decoration media dispenser is positioned
downstream from a strip mover used to move the strip along the production line. In
25 another example, the decoration media dispenser is positioned upstream from the strip
mover.

Two types of decoration media dispensers are disclosed: a sprayer
dispenser and a roller dispenser. The sprayer dispenser is used to spray decoration
media onto the strip. Media and air suppliers under the control of a controller supply
30 decoration media and air to the sprayers. The roller dispenser is used to roll
decoration media onto the strip. A decoration media supplier under the control of a
controller supplies decoration media to the roller dispenser.

Additional features of the disclosure will become apparent to those skilled in the art upon consideration of the following detailed description exemplifying the best mode of carrying out the disclosure as presently perceived.

5 BRIEF DESCRIPTION OF THE DRAWINGS

The detailed description particularly refers to the accompanying figures in which:

Fig. 1 is a diagrammatic view of a method of operating a production line to produce a decorated plastic product by extruding a strip of plastics material
10 from a strip extruder, dispensing decoration media from a decoration media dispenser onto a portion of the strip, and thermoforming the decorated strip portion into the decorated plastic product by operation of the thermoformer;

Fig. 2 is a diagrammatic view of a method in accordance with the present disclosure showing the decoration media dispenser positioned downstream
15 from a strip mover;

Fig. 3 is a side elevation view showing one embodiment of the decoration media dispenser configured as a sprayer dispenser coupled to a frame downstream from the strip mover;

Fig. 4 is an elevation view as viewed in a direction suggested by
20 lines 4-4 of Fig. 3 showing the sprayer dispenser including four sprayers aligned along the width of the extruded strip;

Fig. 5 is a side elevation view of an embodiment of the disclosure showing the sprayer dispenser coupled to media and air suppliers under the control of a controller to provide pressurized decoration media and pressurized air to the sprayer
25 dispenser;

Fig. 6 is a perspective view of one of the sprayers;

Fig. 7 is a side elevation view of an embodiment of the disclosure showing the decoration media dispenser configured as roller dispenser coupled to the frame downstream from the strip mover;

Fig. 8 is an elevation view as viewed in a direction suggested by
30 lines 8-8 of Fig. 7 showing application of decoration media to the strip by a lower applicator roller that receives decoration media from an upper transfer roller;

Fig. 9 is a perspective view of the applicator roller;

Fig. 10 is a side elevation view of the applicator roller;

Fig. 11 is a diagrammatic view of a method in accordance with the present disclosure showing the decoration media dispenser positioned upstream from the strip mover;

5 Fig. 12 is a side elevation view of an embodiment of the disclosure showing the sprayer dispenser coupled to the frame upstream from the strip mover;

Fig. 13 is a sectional view taken along lines 13-13 of Fig. 12;

Fig. 14 is a side elevation view showing the roller dispenser coupled to the frame upstream from the strip mover; and

10 Fig. 15 is a sectional view taken along lines 15-15 of Fig. 14.

DETAILED DESCRIPTION

A method of operating a production line 10 for producing a decorated plastic product is shown, for example, in Fig. 1. Production line 10 includes a strip
15 extruder 12, a decoration media dispenser 14, and a thermoformer 16. Strip extruder 12 extrudes a strip 18 (e.g., a sheet) of plastics material shown, for example, in Figs. 3, 4, 7, 8, and 12-15. Strip 18 is moved along production line 10 in sequence from strip extruder 12 past decoration media dispenser 14 to thermoformer 16. At
20 dispenser 14, decoration media is dispensed from dispenser 14 onto a portion 20 of strip 18, as shown, for example, in Figs. 3, 4, 7, 8, and 12-15. After decoration media is dispensed onto strip portion 20, thermoformer 16 is used to heat and form strip portion 20 into the decorated plastic product.

Additional components of production line 10 are shown diagrammatically, for example, in Fig. 2. The additional components include a melter
25 22, a strip cooler 24, a strip thickness sensor 26, a strip mover 28, a product trimmer 30, and a scrap grinder 32. Melter 22 melts plastic material before it is supplied to strip extruder 12.

Strip cooler 24, strip thickness sensor 26, and strip mover 28 are positioned in production line 10 between extruder 12 and thermoformer 16 along with
30 decoration media dispenser 14. Strip portion 20 moves along production line 10 in sequence from extruder 12 past cooler 24, sensor 26, mover 28, and dispenser 14 to thermoformer 16, as shown, for example, in Fig. 3. Strip cooler 24 cools strip portion 20 just after it is extruded from extruder 12 and includes, for example, five cooler

rollers 34. Strip thickness sensor 26 senses the thickness of strip portion 20 for feedback control of extruder 12.

Strip mover 28 is used to move strip portion 20 along production line 10 from extruder 12 toward thermoformer 16. Strip mover 28 operates in a continuous manner to accommodate the constant-feed operation of extruder 12.

Dispenser 14 dispenses decoration media onto strip portion 20 after strip portion 28 passes strip mover 28. A variety of dispensers may be used to dispense decoration media onto strip portion 20. Two such dispensers are discussed in more detail herein. The decoration media is material (e.g., ink or paint) which can be dispensed onto strip portion 20 and which will remain, at least in part, on strip portion 20 for use on the plastic product.

After strip portion 20 passes dispenser 14, it enters a slack-forming region 35 where slack is allowed to form in strip 18, as shown, for example, in Fig. 3. Such slack forms periodically in strip 18 due to the constant feed of extruder 12 and incremental movement of strip 18 by thermoformer 16.

Thermoformer 16 includes a heater 36 and a former 38, as shown diagrammatically, for example, in Fig. 2. Heater 36 is used to heat decorated strip portion 20 and former 38 forms heated and decorated strip portion 20 into a desired shape to produce one or more decorated plastic products.

Product trimmer 30 is used to trim the one or more decorated plastic product from strip portion 20. The portion of strip portion 20 not formed into a plastic product is passed through scrap grinder 22 for reuse. It is within the scope of this disclosure for product trimmer 30 to be located next to former 38 to trim the decorated plastic products in conjunction with operation of former 38.

Dispenser 14 is included in a decoration media dispenser system 40, as shown diagrammatically, for example, in Fig. 2. A supplier 42 under the control of a controller 44 supplies pressurized decoration media to dispenser 14. Depending on the configuration of dispenser 14, supplier 42 may also provide pressurized air to dispenser 14, as discussed in more detail herein.

A sprayer dispenser 114 shown, for example, in Figs. 3 and 4, is one example of dispenser 14. Sprayer dispenser 114 is used to spray decoration media onto strip portion 20. Illustratively, sprayer dispenser 114 includes four sprayers 116

coupled to a sprayer mount 118 and aligned along the width of strip portion 20, as shown, for example, in Fig. 4.

When used with sprayer dispenser 114, supplier 42 includes a media supplier 46 and an air supplier 48, as shown, for example, in Figs. 3 and 5. Media supplier 46 supplies pressurized decoration media to a plurality of media inlets 120 included in each sprayer 116 and shown, for example, in Figs. 5 and 6. Air supplier 48 includes pressurized air to a plurality of air inlets 122 included in each sprayer 116 and shown, for example, in Fig. 5. The pressurized decoration media and air are mixed in a housing 123 included in each sprayer 116 and the mixture is discharged from a plurality of outlets 124 included in each sprayer 116, as shown, for example, in Figs. 5 and 6.

Media supplier 46 includes a media supply 54, a media pump 56, and a media pressure sensor 58, as shown, for example, in Fig. 5. Media pump 56 pumps decoration media from media supply 54 past sensor 58 to media inlets 120. Sensor 58 senses the pressure of decoration media and provides media pressure information representative of the media pressure to controller 44.

Air supplier 48 includes an air pump 60 and an air pressure sensor 62, as shown, for example, in Fig. 5. Air pump 60 pumps air past air pressure sensor 62 to air inlets 122. Sensor 62 senses the air pressure and provides air pressure information representative of the air pressure to controller 44.

Controller 44 uses the media pressure information from media pressure sensor 58 and the air pressure information from air pressure sensors 62 to control operation of media pump 56 and air pump 60. In this way, controller 44 is able to control operation of media supplier 46 and air supplier 48 so that a desired amount of decoration media will be sprayed onto strip portion 20.

Sprayer mount 118 and other components are coupled to a frame 74, as shown, for example, in Figs. 3 and 4. Frame 74 includes a pair of horizontal beams 76 and four vertical supports 78 to support beams 46 above a floor 80. Sprayer mount 118, a pair of guide rollers 64, strip thickness sensor 26, and strip mover 28 are coupled to beams 46.

Strip mover 28 includes a motor 66, a drive roller 68, and an idler roller 70, as shown, for example, in Fig. 3. Motor 66 is used to rotate drive roller 68 to move strip portion 20 between drive roller 68 and idler roller 70. Motor 66 is

coupled one of beams 46. Drive and idler rollers 68, 70 are coupled to beams 46 by a mover mount 72.

A roller dispenser 214 shown, for example, in Figs. 7 and 8, is one example of dispenser 14. Roller dispenser 214 is used to roll decoration media onto strip portion 20.

Illustratively, roller dispenser 214 includes an applicator roller 216 shown, for example, in Figs. 7-10, and a transfer roller 218 shown, for example, in Figs. 7 and 8. Applicator roller 216 rolls decoration media onto strip portion 20. Transfer roller 218 rolls decoration media supplied thereto onto applicator roller 216. Applicator roller 216 and transfer roller 218 are coupled to horizontal beams 46 by a roller dispenser mount 220.

Applicator roller 216 includes a plurality of media applicator lugs 222 for application of decoration media onto strip portion 20, as shown, for example, in Figs. 9 and 10. Lugs 222 are coupled to a cylindrical body 224. Shafts 226 are coupled to the ends of body 224 for rotation body 224 and lugs 222 therewith.

When used with roller dispenser 214, supplier 42 is configured as media supplier 46, as shown, for example, in Fig. 7. Media supplier 46 supplies pressurized decoration media to transfer applicator 218. Controller uses the media pressure information from media pressure sensor 58 to control operation of media pump 56 so that a desired amount of decoration media will be rolled onto strip portion 20.

A production line 310 is similar in structure and function to production line 10 except that decoration media dispenser 14 is positioned upstream from strip mover 28 so that decoration media is dispensed from dispenser 14 onto strip portion 20 before strip portion 20 passes strip mover 28, as shown diagrammatically, for example, in Fig. 11. Such an arrangement is useful when dispenser 14 is configured as sprayer dispenser 114, as shown, for example, in Figs. 12 and 13, and when dispenser 14 is configured as roller dispenser 214, as shown, for example, in Figs. 14 and 15.

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